

REMARKS

A. Request for Reconsideration

Applicants have carefully considered the matters raised by the Examiner in the outstanding Office Action but remain of the position that patentable subject matter is present. Applicants respectfully request reconsideration of the Examiner's position based on the amendments to the claims and the following remarks.

B. The Invention

The present invention is directed to a combination of a multi-pitch screw and a multi-pitch nut. In one of the novel aspects of the invention, the thread of the multi-pitch screw and the thread the multi-pitch nut are formed with alternating sections having mild and steep lead angles. These alternating sections create a "multi-pitch" aspect which prevents screw looseness and provides a self-locking function between the screw and nut.

The combined screw and nut of the present invention are illustrated in Figures 1-4 of the application. As shown in Figure 1, thread 12 of multi-pitch screw 10 alternates between flat (mild lead angle) sections 12a,12c and angled (steep lead angle) sections 12b,12d as thread 12 spirals around shaft 11 of multi-pitch screw 10. Thread 12 of screw 10 is therefore

"multi-pitched". Similarly, Figure 3 shows that female thread 22 of multi-pitch nut 20 alternates between flat (mild lead angle) sections 22a,22c and angled (steep lead angle) sections 22b,22d as female thread 22 spirals within multi-pitch nut 20. As a result, female thread 22 of nut 20 is also "multi-pitched".

The interaction between the lead angles of multi-pitch screw 10 and multi-pitch nut 20 is illustrated in Figures 4(A)-4(B) and described on page 18, par. 1 to page 21, par. 1. Figure 4(A) shows the condition where a gap exists between thread 12 of multi-pitch screw 10 and thread 22 of multi-pitch nut 20. In this condition, screw 10 does not contact nut 20 and the self-locking condition is not achieved.

In Figure 4(B), multi-pitch nut 20 is urged in the direction of arrow F1. As a result, the flat sections of the multi-pitch nut mate with the flat sections of the multi-pitch screw, while the angled sections of the multi-pitch nut mate with the angled sections of the multi-pitch screw. Since the flat and angled sections mate, the multi-pitch screw cannot rotate due to frictional forces between the mating surfaces (see page 19, lines 3-15). The multi-pitch screw and multi-pitch nut are therefore self-locked.

C. Claim Status and Amendments

In the Office Action, claims 1-19 were indicated as pending. This is an error. The second preliminary amendment filed March 1, 2005 cancelled claim 9, thus, claims 1-8 and 10-19 are pending. The amendments made to the claims herein assumes that the second preliminary amendment was entered.

Claims 1-3, 10, 11, 17 and 18 are presented for further prosecution. Claims 4-8, 12-16 and 19 have been withdrawn from consideration.

Claim 1 has been amended to clarify that the multi-pitch screw has a thread and that the mild and steep lead angles are arranged alternately and continuously. Support for this amendment can be found in Figure 1.

Claims 2, 7, 8, 10 and 15 have been amended to clarify that the mild lead angle of the multi-pitch screw is perpendicular to the axis of the multi-pitch screw. Support for this amendment can be found in Figure 1.

Claims 3 and 11 have been amended to clarify that the steep lead angle of the multi-pitch screw is steeper than an angle which causes said multi-pitch screw to lock. Support for this amendment can be found in Figure 4 and on page 19, lines 3-15.

Claims 5-7, 13-15 and 17-19 have been amended to correct minor grammatical inconsistencies. No new matter has been added.

Claims 7, 15 and 16 have been amended to clarify that the lead angle of the thread of a female screw is perpendicular to the axis of the female screw/nut. Support for this amendment can be found in Figure 3.

The claims have also been amended to refer to the screw of the multi-pitch screw as a male screw as recited in claims 15 and 16.

D. Information Disclosure Statement

The Examiner had refused to consider the IDS filed on September 22, 2004 because copies of the foreign references had not been submitted.

Applicants have enclosed a substitute IDS which cites the previously disclosed references. Copies of the foreign references have been provided with English Abstracts or computer translations to explain the relevance of the references. PTO 2038 is also enclosed for the IDS filing fee. However, it is noted that the references which were not submitted by Applicants upon filing the application should have been in the PTO file since each reference was cited in the ISR, and the JPO was supposed to provide copies of to the US DO/EO (MPEP § 1893.03(g)).

Applicants respectfully request consideration of the references.

E. Rejections under § 112, second paragraph

Claims 3 and 11 had been rejected as indefinite. The Examiner had stated that the self-lock angle is unclear because it is not defined in relation to the screw and/or nut.

As discussed above, Applicants have amended claims 3 and 11 to replace "self-lock angle" with "an angle which causes said multi-pitch screw to lock with said multi-pitch nut". As explained on page 19, lines 3-15 and shown in Figure 4(B), when the thread of the multi-pitch nut mates with the thread of the multi-pitch screw, the screw is locked and cannot rotate because the frictional force between the mating flat sections is greater than the frictional force between the mating steep sections. The "angle which causes said multi-pitch screw to lock" recited in claims 3 and 11 is an angle of the steep sections that creates such a frictional force difference. This angle causes the screw to lock as recited in claims 3 and 11.

Applicants respectfully submit that claims 3 and 11 are definite.

F. Rejections under § 102(b)

Claims 1, 2, 10, 17 and 18 had been rejected as being anticipated by Pearson (US 113,557).

Pearson teaches a screw (Figure 1) and nut (Figure 4) having indentations on either side of the thread (see col. 1, par. 3). The Examiner had taken the position that the indentations of Pearson are the mild and steep lead angles of the claimed invention. Applicants respectfully disagree.

1. The thread of the screw and the thread of the nut of Pearson do not have alternating mild and steep lead angles

As illustrated in Figure 1 of the application, male thread 12 of multi-pitch screw 10 contains flat (mild lead angle) sections 12a which alternate with angled (steep lead angle) sections 12b. Similarly, Figure 3 shows that female thread 22 of multi-pitch nut 20 contains flat (mild lead angle) sections 22a which alternate with angled (steep lead angle) sections 22b. As recited in claim 1, the sections of the thread have the multi-pitch aspect of the present invention.

Pearson differs from the claimed invention because the sections are not multi-pitched. For example, Figure 1 of Pearson shows that the thread has a single section because the thread spirals around the screw in a uniform manner. Pearson therefore does not teach or suggest the alternating mild and steep sections recited in claim 1.

Applicants therefore respectfully submit that claim 1 is not anticipated by Pearson because Pearson does not teach or suggest a thread having alternating mild and steep sections.

2. The indentations of Pearson are not the claimed mild and steep sections

The Examiner had taken the position that the indentations of Pearson are the claimed mild and steep sections. Applicants respectfully disagree.

Pearson explains that the indentations located on the screw are forced into the thread of the nut when the screw is tightened (col. 1, par. 10). Thus, Pearson teaches a screw which projects into the inner surface of the nut.

In contrast to Pearson, the mild and steep sections of the claimed invention do not project into one another. Rather, the mild and steep sections mate along their respective surfaces as shown in Figures 4(A)-(E) in order to lock the screw and nut. The claimed mild and steep sections therefore lock the screw and nut in a different manner than the indentations of Pearson.

Applicants respectfully submit that the indentations of Pearson are not the claimed mild and steep sections.

G. Conclusion

In view of the foregoing and the enclosed, it is respectfully submitted that the application is in condition for allowance and such action is respectfully requested. Should any extensions of time or fees be necessary in order to maintain this Application in pending condition, appropriate requests are hereby made and authorization is given to debit Account # 02-2275.

Respectfully submitted,

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